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ESSENTIALS OF ANATOMY

INCLUDING THE

ANATOMY OF THE VISCERA

ARRANGED IN THE FORM OF

QUESTIONS AND ANSWERS

PREPARED ESPECIALLY FOR

STUDENTS OF MEDICINE

BY

CHARLES B. G. DE NANCREDE, A. M., M. D., LL.D.

Professor of Surgery and of Clinical Surgery in the University of Michigan; Professor of Surgery in the Dartmouth Medical College; Emeritus Professor of General and Orthopedic Surgery, Philadelphia Polyclinic; Ex-President of the American Surgical Association; Member of the International Society of Surgery; Corresponding Member of the Royal Academy of Medicine, Rome, Italy; Member of the American Academy of Medicine, etc.

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PREFACE TO EIGHTH EDITION.

In the present edition, De Nancrede's Essentials of Anatomy has been thoroughly revised, and numerous changes have been made in the text in order that the book may be in accord with the latest teaching in anatomy. The original plan of the book, however, has been retained. Many of the illustrations have been redrawn and several new cuts have been added.

PREFACE TO FIRST EDITION.

The author has endeavored in this little book to embody only those facts which have appeared to him to be really the "essentials of anatomy;" not that he considers it likely that the student will master every minute detail therein contained, but he believes that the knowledge gained by a study of this work will enable the future practitioner, during the remainder of his professional life, to recall such general impressions as will render intelligible current medical literature, or even the more elaborate monographs, and will at once suggest *where* to

consult his anatomical text-books for such terms or facts as may have become indistinct through lapse of time.

While this book cannot replace the larger anatomical works, sufficient descriptive matter has been introduced to enable the student to refresh his memory of the more numerous facts learnt in the lecture and dissecting room, or from his "Gray" or other text-book, differing in this respect from most of the works of its class, which are little more than a list of names, without any distinctive facts connected with them to aid the student in the difficult task of acquiring a knowledge of a branch of medical study almost solely dependent upon the unassisted powers of the memory.

Conciseness, rather than elegance of diction, has been the aim, so that all words such as the articles "a," "an," "the," have been omitted, except where absolutely necessary.

Recognizing that a work of this kind should, as far as possible, conform to that text-book most commonly used, the last edition of Gray's *Anatomy* has been chosen as the chief authority, although free use has been made of the works of Quain, Leidy, Bock, Allen, Morris *On the Joints*, Starr *On Diseases of Children* (dentition), Tomes *Dental Anatomy*, Potter, Frey, Holden, Politzer, H. Thompson, Astley Cooper *On the Breast*, and original work of one of the author's former students.

The author would here acknowledge his obligations and return his thanks to Prof. Joseph Leidy, of the University of Pennsylvania, for the kind permission to reproduce numerous cuts from the first edition of his *Anatomy*, and to Dr. F. M. Varrell for much valuable assistance in the correction of proof.

CHARLES B. G. DE NANCREDE.

CONTENTS.

Essentials of Human Anatomy.

Give the derivation and meaning of the term anatomy.

From two Greek words, *ἀνά*, apart, and *τέμνειν*, to cut, literally meaning dissection; but it is used to indicate the study of the physical structure of organized bodies.

How is human anatomy divided?

Into two great divisions, viz.: 1. General or descriptive anatomy, which deals with the separate parts of the human body. Histology is a part of general anatomy in which the structural elements are studied, usually with the aid of a microscope. 2. Surgical or regional anatomy describes the relations which individual parts—muscles, nerves, arteries, etc.—bear to each other.

What is osteology?

A subdivision of general anatomy, describing the number, form, structure, and uses of the bones.

What is the chemical composition of osseous tissue (bone)?

About one-third (33.3) is organic or animal matter, resolvable into gelatin after prolonged boiling, with traces of chondrigen (the proximate principle of cartilage), and two-thirds inorganic (66.7), consisting of calcium phosphate (tribasic) 51.04, calcium carbonate 11.30, calcium fluorid 2, magnesium phosphate 1.16, and sodium chlorid with traces of sodium dioxid 1.20. Either the organic or the inorganic matter may be removed without affecting the form of the bone; the former, by exposure to heat with free access of air, after which slight force will reduce the bone to powder; the latter, by steeping in dilute hydrochloric acid, which will render a bone as pliable as a strip of rubber. In rickets only about 20 per cent. of lime-salts are deposited and 80 per cent. of animal matter.

Does an increase of the mineral constituents take place in old age?

No, although this is a common statement in text-books; for while equal *bulks* of young and old bones do show marked differences in the proportion of earthy and animal constituents, equal *weights* do not, so that the elasticity in youth and the brittleness in age depend upon the greater sponginess of texture in young bones.

Is bone a homogeneous substance?

No; for while the exterior is composed of a *compact* (hard, ivory) layer, the inner portions are formed of *spongy* or *cancellous* tissue; the interior of long bones is hollow, forming the medullary (marrow) canal. The compact tissue occurs upon the exterior or in the shaft of long bones where "cross-strain" is greatest; whereas cancellous tissue enables the articular ends of the bones to be large for security, yet light, this tissue being capable of bearing enormous pressure, but incapable of bearing much "cross-strain." Probably all solid bone is a definite compound.

Describe the microscopic structure of bone.

In transverse section, with a low power, a number of holes will be observed, averaging $\frac{1}{500}$ inch in diameter, surrounded by a series of concentric circles, consisting of an interrupted series of dark spots. With high powers the holes, called *Haversian canals* for the passage of vessels, are seen to be surrounded by a series of concentric rings, termed lamellæ, while the dark spots reveal themselves as cavities in the bone, called *lacunæ*, intercommunicating with each other and the central Haversian canal by means of delicate radiating lines, called *canaliculi:* this aggregation of structures is called an *Haversian system.* The lacunæ contain bone-corpuscles, processes of which extend into the *canaliculi.* Each Haversian canal communicates either directly or indirectly with the marrow cavity of the bone internally and with the deeper layers of the periosteum externally, so that processes of the marrow, on the one hand, and of the periosteum, on the other hand, containing nutrient vessels, pass to all parts of each Haversian system. As these systems are circular, they would leave interspaces where not in contact; but these gaps are filled up by *bone*

lamellæ, *lacunæ*, and *canaliculi*, called *interstitial lamellæ.* In addition to the *Haversian lamellæ* of the Haversian systems, other lamellæ are found arranged concentrically to the circumference of the bone, called *circumferential lamellæ.* The circumferential lamellæ are held together by the *perforating fibers of Sharpey.*

What are the periosteum and the endosteum?

The periosteum is a membrane serving as a scaffolding to enable the blood-vessels to reach all portions of the exterior of the bone except its articular ends and the points of attachment of strong tendons. It is composed of two portions: the *outer* or *fibrous layer* is dense and protective; the *inner layer* is vascular and contains many *osteoblasts*, or bone-forming cells, upon which the growth in thickness of the bone depends.

The term endosteum is applied to the delicate connective-tissue lining of the medullary and cancellous cavities which contains numerous bone-forming cells.

Describe the medulla or marrow.

There are two varieties, *yellow* and *red:* yellow marrow occurs in the shaft of adult long bones, and is 96 per cent. fat; red marrow occurs in the ends of long bones and contains 72 per cent. of water and a trace of fat. The red marrow of the adult is a lymphoid tissue which is engaged in the formation of red blood-corpuscles. In addition to a framework of connective tissue supporting blood-vessels and nerves, there are seven varieties of cells in this tissue: myelocytes, nucleated red blood-corpuscles, non-nucleated red blood-corpuscles, giant cells, polymorphonuclear leukocytes, eosinophile cells, and mast-cells.

Do bones receive blood only from vessels in the periosteum?

No; for the medullary tissue of all long bones receives a good-sized artery (the medullary artery), which obliquely penetrates the compact tissue, after which it divides into two main branches, one ascending, the other descending, in the medullary canal; the veins chiefly emerge through numerous openings near the articular ends of the bones.

Describe the process of ossification.

There are two methods, viz.: (1) *intramembranous;* (2) *intracartilaginous.* The bones of the vertex of the skull

and those of the face, with few exceptions, are formed in membrane; the base of the skull and the other bones of the body and limbs are formed in cartilage. (1) In the former the bone-forming cells (*osteoblasts*) arrange themselves along the thick bundles of fibrous tissue which radiate from the center of the future bone; by the deposition of lime-salts around these osteoblasts the deposit of bone shoots out in needle-like rays toward the circumference. (2) A deposit of bone begins at one spot of the cartilage, the *primary center*. The shaft is formed from this. Just before ossification commences the cartilage-cells enlarge and arrange themselves in rows. Lime-salts are deposited in the matrix between the rows, forming columns which enclose oblong spaces containing cartilage-cells, called the *primary areolæ*. Now ossification proper commences by the ingrowth from the periosteum of buds of young connective tissue covered with bone-forming cells, which, after causing absorption of the cartilage, become converted into bone.

Of how many bones is the adult human skeleton composed?

Two hundred, including the os hyoides, but excluding the teeth, Wormian bones, all sesamoid bones except the patellæ, and the ossicles of the middle ear.

Into what classes are bones divided?

Long bones, as femur, tibia, etc., about 90 in number; *flat*, as those of the vault of the skull, scapula, ribs, patella, about 40; *irregular*, as the vertebræ, usually symmetrical, about 40; and *short*, such as the carpal and tarsal bones, numbering 30.

What are Wormian bones?

Irregular fragments, developed from supplementary centers, situated at the junction of two or more cranial sutures, where, during infancy, a membranous interval existed, viz., a *fontanelle*. From their triangular form they are often called *ossa triquetra*.

What are sesamoid bones?

Those developed in the substance of tendons, whereby the muscles obtain additional *leverage—i. e. power;* the patella and pisiform are classed with these bones.

Of what parts do long bones consist, and what are their uses?

Of a shaft (body, diaphysis), two articular extremities, and various processes; they are developed in cartilage, from one principal and one or more additional (epiphyseal) centers of ossification; they serve as supports and levers for power and progression.

Where are short and flat bones employed, and why?

In the carpus and tarsus, where strength with limited motion is required. The flat bones consist of two layers of compact tissue with interposed cancellous tissue, called *diploë;* they serve for protection and muscular attachment.

What facts are noted concerning the medullary arteries?

1. Medullary arteries run *from* the knee and *toward* the elbow. 2. The secondary center *from* which the artery runs is the *first* to appear. 3. The epiphysis *first* to appear is *last* to unite.

Give the names and characteristics of the chief articular processes.

Head, a convex smooth projection, with a constriction or neck beneath; found in freely moving joints.

Condyles, double projecting processes, may have a constriction or neck—*i. e.* neck of condyle of jaw.

Name and define some of the non-articular processes.

Trochanters, short projecting levers near articulations to facilitate *rotation* of the bone on its long axis.

Tuberosities, roughened, broad prominences.

Tubercles, similar to the above, but small with reference to the size of the bone.

Spines and *spinous processes*, more or less pointed projections.

Apophysis, strictly speaking, any bony process which develops from the primary center of ossification, commonly used, however, for any process, even if an epiphysis, *after* it has coössified with the mass of the bone. Certain descriptive terms are used: *azygos*, without a fellow; *coracoid*, like a crow's beak; *mastoid*, like a nipple; *rostrum*, a beak; *styloid*, pen-like; *squamous*, like a scale; *vaginal*, ensheathing; *clinoid*, like a bed.

Name some of the articular cavities of bone.

Cotyloid, when they resemble a deep cup; *glenoid*, when

they have a shallow cup-form; *trochlear*, pulley-like; *facet*, when smooth, like one of the surfaces of a cut gem; *sigmoid*, when *c*-shaped, resembling the old Greek letter for ς.

What are the principal non-articular cavities called?

Fossæ, shallow depressions; *sinuses*, deep cavities, communicating with the exterior by small openings; *grooves*, long, narrow depressions; *fissures*, cracks; *notches*, deficiencies of edges of bones; *foramina*, holes through bones for transmission of nerves, etc.

What is a diaphysis?

The main portion of a bone (shaft in a long bone, body in an irregular one) between the *epiphyses*.

What is an epiphysis?

A supplementary center, usually to provide for growth in *length*, developed in cartilage, which remains separated by a layer of *epiphyseal cartilage* until the growth of the bone is completed, when it coössifies with the *diaphysis*, and all further growth ceases. Epiphyseal centers appear after birth: they coössify in the inverse order of their appearance, except that of the lower end of the fibula. This process of coössification commences about puberty, and the last to unite are those of the upper end of the tibia and the vertebral bodies—as late as twenty-five years.

BONES OF THE HEAD.

Name the bones composing the skull.

They are twenty-two in number: eight of which (*cranial*) compose the brain-case, viz., one frontal, two parietal, two temporal, one sphenoid, one occipital, and one ethmoid; fourteen are *facial*, two superior maxillary, two malar, two nasal, two lacrimal, two palate, two inferior turbinated, one vomer, and one inferior maxillary, or mandible; the ethmoid of the cranium also enters largely into the formation of the nasal cavities.

The Frontal Bone.

Of what parts does this bone consist?

Of a vertical and a horizontal portion, meeting at an angle of 60°.

Describe the points on the outer surface of the vertical portion (Fig. 1).

On each side of the median line are two *frontal eminences*, between which are the remains of, or the obliterated (*metopic*) *frontal suture*, leaving a slight linear *depression*, which, above the root of the nose, terminates in a rounded, projecting *nasal*

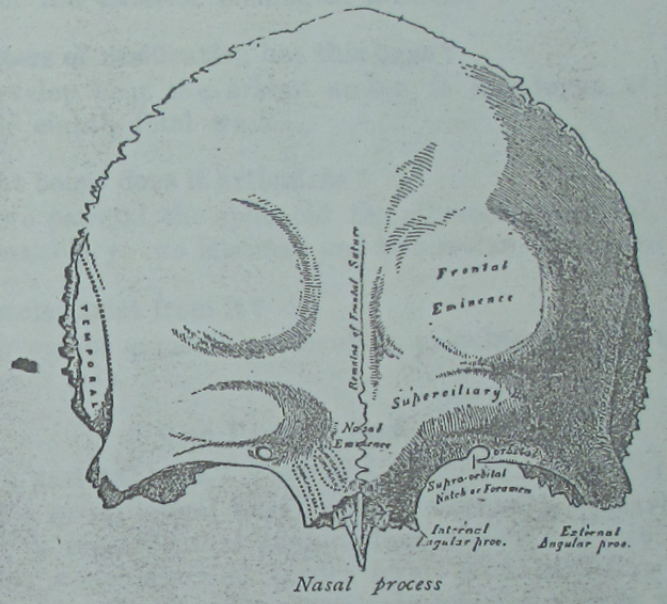

FIG. 1.—Frontal bone, outer surface (Gray).

eminence (glabella). Extending from this on each side are two curved, rounded *superciliary ridges*, situated behind which, between the two tables of the skull, lie the *frontal sinuses* (Fig. 2). The junction of the vertical and horizontal portions forms on each side a curved margin, the *supra-orbital arch*, notched or perforated toward its inner part by the *supra-orbital notch*, or *foramen*, transmitting the artery and nerve of the same name. Each orbital margin terminates by two stout processes, called *internal angular* and *external angular processes*. Between the two inner projects the *nasal process*, in the rough, uneven space, called the *nasal notch*; the under surface of the nasal process presents a median ridge, *nasal spine*, between two

grooves. The margin of the external angular process extends upward as the *inferior temporal ridge* (Fig. 1).

Describe the points on the cerebral surface.

In the median line a *frontal sulcus* (Fig. 2) (for the longitudinal sinus) exists, whose edges coalesce below to form the

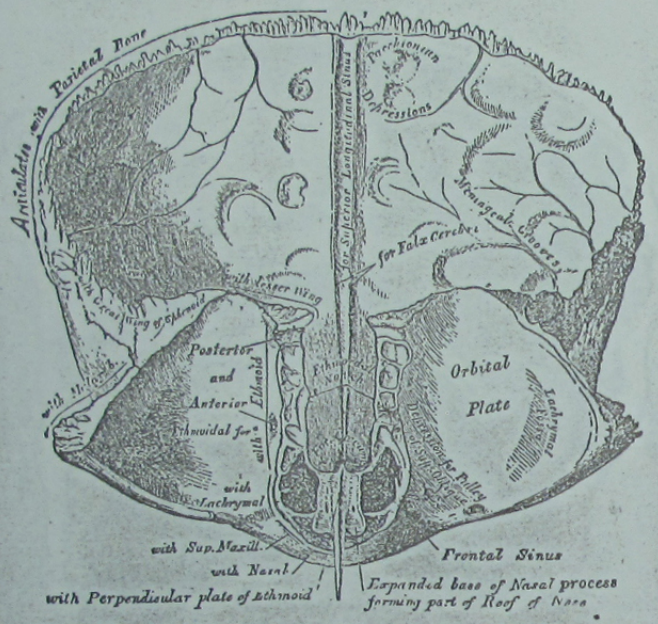

FIG. 2.—Frontal bone, inner surface (Gray).

frontal crest, which terminates as a notch, or perhaps complete *foramen cæcum* (blind), which when pervious transmits a small vein.

Describe the horizontal portion.

This consists of two *orbital plates* of a triangular outline, separated by a quadrilateral *ethmoidal notch* (for articulation with the ethmoid). A shallow *lacrimal fossa* (for the gland) exists at the outer part of the orbit, also a *trochlear fossa* or sometimes a small *tubercle* at the anterior inner part for the pulley of the superior oblique muscle. Several half cells are seen along the margins of the ethmoidal notch, which complete the ethmoidal cells when the ethmoid is in position, as well as two

grooves, which are likewise converted into the *anterior* and *posterior ethmoidal canals*, the former for the nasal nerve and anterior ethmoidal vessels, the latter for the posterior ethmoidal vessels. On each side of the nasal process open the *frontal sinuses* (absent in infants), a part of the nasal cavities, into which each opens by the *infundibulum*. The cerebral surfaces of both vertical and horizontal portions present numerous depressions for the convolutions of the brain, and branching grooves for the anterior meningeal arteries.

What centers of ossification has this bone?

Two develop near the orbital arches, in membrane, at the seventh or eighth fetal week.

With what bones does it articulate?

With two parietal, the sphenoid, the ethmoid, two nasal, two superior maxillary, two lacrimal, and two malar—twelve in all.

What muscles arise from it?

The corrugator supercilii, orbicularis palpebrarum, and temporal on each side.

The Parietal Bones.

Describe a parietal bone?

It is of a quadrilateral form, convex externally, concave internally. It presents four borders, four angles, and two surfaces. Its upper serrated border forms with its fellow the *sagittal suture;* the anterior alternately bevelled margin joins the frontal, forming part of the *coronal suture;* the inferior border presents three parts, bevelled in front for the wing of the sphenoid, next for the squama, then serrated for the mastoid; the posterior serrated border articulates with the occipital (*lambdoid suture*). The antero-superior angle is at the junction of the coronal and sagittal sutures; the antero-inferior angle fits under the wing of the sphenoid and internally presents a groove or canal for the anterior branch of the middle meningeal artery; the postero-superior angle marks the apex of the lambdoid suture (Lambda); the postero-inferior angle articulates with the mastoid and internally shows a groove for part of the lateral sinus.

The *external surface* shows near its center the *parietal emi-*